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ABSTRACT

The nature of society, technology, and education is related to the future and there is a need to explore the implications that each has upon industrial arts education. The incredible advanced technologies that have affected society are starting to affect education and are sure to change many characteristics of industrial arts education. As educators leading students in experiences aimed at enriching lives through the study of technology, we have to make value decisions about the nature of content which is to be taught. Regardless of one's philosophy and content interest, the study of industrial arts will increasingly evolve from an international base. We are on the edge of a new and interesting era in education. A characteristic of this era will be the use of electronic technology in the classroom as teaching aids. However, many characteristics related to learning will remain the same. Industrial arts educators should be preparing students for their future by assisting them in the study of the many technological solutions to societal problems which exist today or will be present in the years to come. Industrial arts teachers should be familiar and utilize the different forms of methodologies and activities which allow for the study of the future. (EM)

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TOWARD THE FUTURE: SOCIETY/TECHNOLOGY/INDUSTRIAL ARTS

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> Through his images of the future, we come to know man, who he is and how he wishes to be, what his thoughts are, what he values most highly, what he thinks is worth striving for, and whether he thinks it is attainable. . .
>
> Dr. Fredrick L. Polak

My intention here today is to review the nature of society, technology and education as related to the future and to explore the implications that each has upon our profession. While it is not my intention to review the historical role of industrial arts, I will often refer to past and present times in an attempt to develop directions for our field. Plato presented us with a vision of what the order of society should be and how it must be ruled to be ideal. I do not intend to establish an order to society or suggest what each of you should do to have the ideal situation. Nor, do I consider myself in the same class as Plato. I do believe,however, that as dedicated and responsible educators, we can effectively explore the alternatives available to us in order to provide an education for our students which will prepare them to be responsible members of society.

Technological man is with us today, you and I are among the first of them. We have no precedent for this new man as we did in the Renaissance, wherein the regeneration of man took place according to thoughts originating from the Greeks. We in the field of industrial arts may presently be going through our own Renaissance. Perhaps, as blindly as we endured the years previous to the Industrial Revolution. Technological changes are now taking place with the whole world looking on through satellite communication systems which have dissiminated facts and conveyed events. During the past few years interested faculty members at the University of Maryland have been working with an approach to looking at futuristic technology

in an attempt to study technological developments which are yet to occur. This approach has been explored because technological advancements have almost completely altered our form of existence in society. Theodosius Dobzhansky once wrote that:

> By changing what he knows about the world, man changes the world he knows; and by changing the world in which he lives, man changes himself (p. 30).

Our habits, values and morals have been changed since the days of our ancestors. We have experienced such technological events as moon walks, exploration of other planets for life, and the building of huge structures with computerized controls such as those used in the last Olympic games or the "Superdome" in New Orleans.

The incredible advanced technologies that have affected society are starting to affect education and are sure to change many characteristics of industrial arts education. The following are just a few of the events which man now has or soon will have the capability to manipulate:

> We can obliterate the species of man through nuclear or bacteriological warfare.
>
> We appear to soon be able to alter genetic structure consciously and in the direction of specified goals.
>
> We can build self-replicating machines and totally unfamiliar man-machine organisms.
>
> We can alter personality through drugs.
>
> We can stimulate pleasure centers of the brain electronically.
>
> We can create a hedonistic hell on earth or a savage totalitarianism, or any of a variety of benign utopias, or virtually anything in between. (Toffler, 1971, p. 2)

These events are dealt with directly or indirectly by professionals in politics, urban planning, international affairs, science and technology. Educators face similar questions in making decisions about course content and in planning interest sessions for students.

The future depends, in part, on the values fed into the decision-making process. Also, decisions depend upon how we understand and predict changes in values that regulate behavior. We have reached a period in time when all values are under strain and are constantly challenged. Few institutions, beliefs or values can any longer be taken for granted. Technological change has had an important effect on our value systems.

As educators leading students in experiences aimed at enriching lives through the study of technology, we have to make value decisions about the nature of content which is to be taught. For example,

+ Should industrial arts content be organized around issues and problems associated with technology or around jobs, skills, careers and occupations?
+ Should subject matter focus on the work of selected skilled tradesmen or on industrial technology?
+ Should emphasis be placed on traditional industrial arts activities such as wood, metal, etc. or be grouped into broader areas of study (e.g. - materials and processes, communications, etc.)?
+ Should industrial arts facilities continue to have the present construction activity environment or approach a research laboratory setting?
+ Should the laboratories used for construction be of a general industries nature or be a unit or specific laboratory?

Alternatively, all of these questions could be summarized by asking if industrial arts should be occupational-vocational in nature or general education oriented!!!

Many industrial arts teachers may be perplexed at this point

as to what relationship our field has with self-replicating machines or nuclear warfare, there is a strong relationship. We in the field of industrial arts deal with human beings and human beings make the decisions related to what values are important. We deal with technology and technology produces all of the events which I have just discussed. For those two reasons; we in the field of industrial arts education should be aggressively researching the technological events which have and are going to take place in the coming years. We have the methodologies, facilities, and capabilities to provide meaningful educational experiences for youngsters giving them practice in researching, inquiring, analyzing, planning, organizing, creating, constructing, experimenting, evaluating and reporting. These are the characteristics which individuals must develop to become successful contributing members of society. As a profession, we should not be ignoring an opportunity to present the facts about our technological society to our students. The study of technology should truely be a part of one's general education.

Regardless of one's philosophy and content interest as related to our profession, the study of technology will increasingly evolve from an international base. We have come to a time in education where we cannot just consider content from a national viewpoint. We as educators must alter our strategies whether teaching a theory course at the graduate level or a technical course in the junior high school. As Roy Klein (1976) noted in his article, "The Materials Revolution", "within a decade social and political pressures will have forced industry to change the material composition of almost every product". Klein attributes the materials revolution to political situations such as presently exist in Rhodesia and

Chile where the exports of copper to the United States could easily be stopped. Thus, aluminum wiring and automobile radiator cores may replace copper. Recently, American companies have entered into agreement with Puerto Rico regarding aluminum mines in that the United States companies will own but Puerto Rico citizens will work and receive some profits from the mines. Political situations such as these are going to increasingly affect the industrial arts teacher whether he or she realizes it or not. Students in industrial arts classes will therefore need to study technology from an international base as the multinational corporations take over the world's manufacturing assets. These international implications will continue to influence our classroom discussions as the third world nations seek more power.

In the past, it may not have been realistic to think of a world society, but it is necessary to do so today. Within my lifetime, it has been realistic to think of industrial arts as wood shop, drawing, etc. where learned skills could be applied in local community situations. It has been a time when technology was considered less involved. Materials of all types were more in abundance and the issues related to pollution had not attained national concern. Now the situation is entirely different. The progress made in telecommunications has broadened the awareness of technology to the point where we learn that the sciences of medicine consider the use of bionics, electric power may possibly be transmitted without the use of wires and where the study of agriculture includes ocean farming. During these progressive times studies in industrial arts have started and will continue to move in the direction of the application of technology in the solution of major problems facing mankind.

We are on the edge of a new and interesting era in education. A characteristic of this era will be the use of electronic technology in the classroom as an aid to the teacher. The types of electronic technology that will be applied are television, audio-and videotapes and discs, cable television and computers. In the more distant future the use of microwave transmissions may be common. These technologies will be applied individually with success and failure until enough experience is gained so that they can successfully be applied to classroom situations. The use of this electronic technology will continue to increase as prices of hardware become more within the budgets of the public schools. New uses of educational technology will affect the instruction of industrial arts in the classrooms.

Many fascinating events lie ahead for us in the future in education. But at the same time, many characteristics related to learning will remain the same. In the future, just as the present students will strive for certain psychological and developmental needs. The psychological needs will relate to safety, belonging, love, esteem, self actualization, desires to know, desires to understand and aesthetic considerations (Maslow, 1943). These psychological concepts are known as Maslow's hierarchy of learning wherein it is believed that healthy children will continue to enjoy growing, moving forward, gaining new skills, capacities and powers. As teachers, we will always have to consider the characteristics of learners. How do different age levels respond to learning situations? How can we facilitate the elements of learning such as remembering, transfer of facts, concepts, skills and attitudes? How do we arouse interest in students; attain a zest for learning? Just how do people learn? Maslow wrote that:

> Every human being has two sets of forces within him. One set clings to safety and defensiveness out of fears, tending to regress backward, hanging on to the past, afraid to grow . . . ., afraid to take chances, afraid to jepordize what he already has, afraid of independence, freedom and separateness. The other set of forces impels him forward toward wholeness of Self and uniqueness of Self, toward full functioning of all his capacities, toward confidence in the face of the external world at the same time that he can accept his deepest, real, unconscious Self (Biehler, 1971, p. 321).

Maslow believed that for an individual to attain growth and accept his deepest, real, unconscious Self, the choices between these two sets of forces could be attained from the help of others through positive assistance. This is the type of assistance that instructors in education should be giving to their students. This is also the type of educational situation which is needed to better prepare youngsters for a fast moving, highly sophisticated, technological society.

I have posed the question - how do different age levels respond to learning situations? In asking this question, I am eluding to the developmental needs of youngsters at the age with whom industrial arts educators frequently work -- the adolescent ages, 12-18. Developmental needs arise at certain periods in the life of an individual, which if successfully achieved will generally lead to happiness and success while failure will produce the opposite effect (Havinghurst, 1952). Timing these behavioral needs in industrial arts instruction has an important effect upon educational efforts for as Havinghurst wrote:

> When the body is ripe, and society requires, and the self is ready to achieve a certain task, the teachable moment has come. Efforts at teaching which would have been largely wasted if they had come earlier, give gratifying results when they come at the teachable moment, when the task should be learned (p. 5).

Havinghurst's work is known for the identified developmental tasks which he believed individuals at different age levels encountered. The following is a list of developmental tasks Havinghurst identified as being important during the adolescence years.

Achieving new and mature relations with age-mates of both sexes.

Achieving a masculine or feminine social role.

Accepting one's physique and using the body effectively.

Achieving emotional independence of parents and other adults.

Achieving assurance of enonomic independence.

Selecting and preparing for an occupation.

Preparing for marriage and family life.

Developing intellectual skills and concepts necessary for civic competence.

Desiring and achieving socially responsible behavior.

Acquiring a set of values and an ethical system as a guide to behavior.

These concerns of Maslow and Havinghurst should alert the industrial arts educator to the fact that we cannot just teach our student about woods, technology or the future without first considering the needs of the student. A program consisting of a study of the future of technology must be aimed at the needs of the individual. Approaches to learning should take into consideration -

psychological concepts

behavioral needs

learning theory

physiological needs

educational technology

curriculum trends

An educational program lacking these elements related to learning, may

not be a complete education for the youngster. For as Havinghurst stated, "the teachable moment must come' and the teacher must manage the educational situation to provide the meaningful experience for the student. Lewis Mumford (1973) noted that man has command of forces at his disposal to direct organic and human development toward ideal ends which could be imaginatively conceived. Mumford wrote:

> . . .there comes a moment when knowledge must be applied to action, when action must be guided by rational plans, when plans must be laid out in terms of an ideal goal, and when the ideal goal must be choosen consciously with a view to the kind of self we are trying to produce (p. 483).

In the student's quest to learn about himself and how to control his environment. an awareness of the major societal problems existing today should be examined. Questions such as the following may be posed to the student -

- How can we control pollution, waste and junk disposal for cleaner air, water, and better utilization of land?
- What forms of housing will be needed to provide shelter for this planet and others during the coming years?
- What forms of power generation will be most appropriate for our already sophisticated society?
- What conservation and resource utilization methods need to be applied to aid us in making better use of our resources?
- How can we make our transportation systems more effective for ground, sea, air, and interplanetary travel?
- What new processes will be used by industry to make production techniques more effective?
- How will communication systems be used to enrich and enlarge life?

These are only a few questions which may be asked to stir interest among industrial arts students. Each of these questions may be

answered with many alternatives which are being experimented with today. For example, forms of power generation are presently being tested to refine and possibly implement alternative power sources. A few of these alternatives are as follows:

Large scale fuel cells

Use of radioisotopes

Tidal power

Geothermal energy

Air reservoirs

Power from garbage

Producing solar energy

Controlling nuclear power

Lasers triggering thermonuclear fusion

Fission power

Note that this is just an abbreviated list of alternatives which are presently being explored for use in our technological society. Other lists could be developed for questions relating to:

COMMUNICATIONS

Laser writing

Spoken print being made into printed speech

Forms of global communications

Speech compression for speed listening

Sorting baggage by voice command

Using holography for three-dimensional movies

Electronic libraries

TRANSPORTATION

Tube transit people movers

Flying trains

Satellite control of air traffic

Vapor turbine automobiles

Sonic-boom softeners

Airborne trolleys

Personal underwater propulsion vehicles

CONSERVATION & RESOURCE UTILIZATION

Gelling and dispersing oil spills

Developing ceramic materials from waste

Clean cars

Pollution free energy from offshore winds

Deep sea food storage

Developing protein from wastes

Ocean farming

INDUSTRIAL PROCESSES

Eye movement command machines

Ultrasonic dishwashing

Computer prevented mine disasters

Faster mail sorting

Touch tone shopping

Instant diagnostic information for identifying production line trouble spots

World-wide data-banks on productivity

Disappearing plastic

Space manufacturing

HOUSING

Lunar housing

Building with lasers

Floating cities

Nuclear powered refrigerators

Computers as policemen

Refinements in solar housing

Solar cooking

Ultrasonic sewing

Again, I must emphasize that these are only abreviated lists of technological happenings which could be studied in the industrial arts classroom. Many of these solutions to technological problems remind us of the kinds of events popularized by science fiction writers. But just as yesterday's scientific fantasies have become today's realities, today's experiments may lead to important discoveries tomorrow. Students in industrial arts can profit by gaining an insight to these forms of technology which may be an important part of our existence in the future.

Now that some alternatives to technological problems have been explored, methodology for implementing the futuristic program must be considered. There are many elements of our present industrial arts programs which are very important and should not be forgotten in our instruction as we look into the future. For example, the project should continue to be an important phase of industrial arts. The development of manipulative skills and problem solving techniques should remain in our programs. Students should continue to become acquainted with the world of materials and their uses. Opportunities to transfer learned knowledge as needed to solve problems in practical situations should continue to be in evidence in our programs. However, there are many more characteristics which need to be added to our instructional content. A method must evolve to allow the students to seek answers to questions of a technological nature. The student should also be provided with a means of completing

construction (laboratory) activities which relate to the nature of the program. The traditional forms of communicating with a class such as the lecture, demonstration, and discussion are naturally used in this situation. Other activities such as the unit project, group project, line production procedures, research-experimentation approach, scenario building, and simulating and gaming procedures may be utilized. All of these approaches will allow for construction activities in the industrial arts classroom while concentrating on specific topics related to technology and the future.

When considering any of the methods for implementing futuristic activities into the classroom, the teacher must first prepare the class for such a study. Teacher led presentations and discussions need to be conducted to assist the students in orientating themselves toward the future. Questions must be asked to stimulate interest. Basically, a learning readiness must be developed by the students studying the future. The second major step in the process of implementing future studies depends upon the type of methodology chosen by the teacher. Sometimes this methodology is chosen with the assistance of the students. If individual projects are going to be constructed by each student, then a direction has to be established as to what is to be studied. For example, the class may choose to study problems associated with transportation. Each student would then pick a particular problem related to transportation and develop his/her project around that theme. Or, if a research-experimentation methodology is chosen, each student would then consider procedures for testing and experimenting a selected technology.

On the other hand, group oriented activities may be used for conducting the learning process. One example of a group project

related to housing would be a solar heating building. Or, a class could construct lunar transportation vehicles. Scenarios may be developed suggesting an outline from which a class could produce a course of action requiring construction activities. Gaming and simulation techniques may be used to stimulate group process procedures. These techniques may require value clarification, role playing, discussions and debating, and lend themselves to solving or help in understanding difficult and unfamiliar problems.

The different forms of methodologies and construction activities which allow for the study of the future should not be unfamiliar to the experienced teacher. Many teachers utilize individual projects, group projects, and the other methodologies that I have discussed. The methods are used in a different manner allowing for a new direction in studying about technology. The nature of project construction is also different from the type of projects which the industrial arts teacher commonly observes. The construction activities require the same manipulative skills that are common in any other program but are utilized toward a different type of project - one that will have some significance either technically, scientifically, sociologically, or economically in the future life of the student. Any type of materials, tools, or machines may be utilized in this approach. Most industrial arts facilities can be adapted to some methodology used in this futuristic study. The students are engaged in project construction which is unique to their own interests and ability level. And, instruction may be given on laboratory tools and equipment when the need arises allowing the instructor to emphasize such qualities as function, design, or craftsmanship.

When reviewing the educational principles which are put into

practice with this approach, it is soon apparent that the students develop the ability to learn how to learn. Through the assistance of the teacher, fellow students, and other resource personnel, the student soon learns sources of information, how to acquire the information, and put the acquired materials into a project construction activity. Along with this learning how to learn, the students develop social skills that may be used for life-long learning (e.g. letter writing, making phone calls, research and presenting materials to others). Research and construction activities are individualized. Because each student is allowed to choose a project that is of interest to him/her, each person may perform or be challenged at his/her own ability level without being held back or being left behind by the rest of the class. At the same time, the exceptionally bright student is not limited by the rest of the class or by the teacher's knowledge.

To summarize, in approximately one century, the American people have progressed from a frontier of dirt floors, wood stoves and iron caldrons to an environment which is seemingly more comfortable. This progression has been as a result of many visions and concepts formed by our ancestors. During these years, habits, values and morals have changed considerably. The future presents a new challenge, for technology has and may become increasingly complex and sophisticated. As individuals, we can project as many possible futures as we have ideals, values, goals and plans. As industrial arts educators, we should be preparing our students for their future by assisting them in the study of the many technological solutions to societal problems which exist today or will be present in the years to come.

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